

Durham Research Online

Deposited in DRO:

05 April 2017

Version of attached file:

Accepted Version

Peer-review status of attached file:

Peer-reviewed

Citation for published item:

Bulkeley, H. and Coenen, L. and Frantzeskaki, N. and Hartmann, C. and Kronsell, A. and Mai, L. and Marvin, S. and McCormick, K. and van Steenberg, F. and Voytenko Palgan, Y. (2016) 'Urban living labs : governing urban sustainability transitions.', *Current opinion in environmental sustainability*, 22 . pp. 13-17.

Further information on publisher's website:

<https://doi.org/10.1016/j.cosust.2017.02.003>

Publisher's copyright statement:

© 2017 This manuscript version is made available under the CC-BY-NC-ND 4.0 license
<http://creativecommons.org/licenses/by-nc-nd/4.0/>

Additional information:

Use policy

The full-text may be used and/or reproduced, and given to third parties in any format or medium, without prior permission or charge, for personal research or study, educational, or not-for-profit purposes provided that:

- a full bibliographic reference is made to the original source
- a [link](#) is made to the metadata record in DRO
- the full-text is not changed in any way

The full-text must not be sold in any format or medium without the formal permission of the copyright holders.

Please consult the [full DRO policy](#) for further details.

Manuscript Number: COSUST-D-16-00014R1

Title: Urban Living Labs: Governing Urban Sustainability Transitions

Article Type: 20 Transformations and co-design 2016

Corresponding Author: Dr. Kes McCormick,

Corresponding Author's Institution:

First Author: Harriet Bulkeley

Order of Authors: Harriet Bulkeley; Lars Coenen; Niki Frantzeskaki;
Christian Hartmann; Annica Kronsell; Lindsay Mai; Simon Marvin; Kes
McCormick; Frank van Steenbergen; Yuliya Voytenko Palgan

Abstract: Urban Living Labs (ULL) are advanced as an explicit form of intervention delivering sustainability goals for cities. Established at the boundaries between research, innovation and policy, ULL are intended to design, demonstrate and learn about the effects of a range of urban interventions in real time. While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. While much of the existing literature draws attention to the aims and workings of ULL, there have to date been fewer critical accounts that seek to understand their purpose within the shifting landscape of urban development. In this paper, we suggest that transition studies and the literature on urban governance offer important insights that can enable us to address this gap. We illustrate how insights from transition studies can inform us about the role of ULL as 'niches' within wider urban regimes and the kinds of dynamics that are important to their success (and failure). We suggest that the debate on urban governance can provide us with a perspective that takes into account not only the institutional arrangements through which ULL are pursued, but to more fundamental questions about the capacities they enable through creating new forms of power and agency. Armed with these insights, we conclude that work on ULL needs to account for how they are designed or configured, the practices they undertake, as well as the processes through which they seek to foster broader urban transformation.

Response to Reviewers

We would like to thank the reviewers for their positive comments and constructive critique that has enabled us to further develop the paper and tighten our arguments. Specifically we have addressed the following concerns.

Further justification for the focus on urban governance – Both reviewers asked us to develop the argument for why a focus on the governance dimensions of ULL was particularly useful or necessary. We have done this by extensively reworking the introduction.

Further justification/development of the power/agency focus – Reviewer 1 asks us to consider whether the 'knowledge' dimension of governance should be given more weight, and the power dimension reduced in emphasis. In the paper, we make the argument that transition studies and other perspectives have heavily invested in the institutional dynamics of urban experiments in general, and ULL in particular, and have had a specific interest in the role of knowledge/learning as determining the potential of ULL. Our interest in power/agency is seen as supplementary to this (as set out in the paper) and the concluding section seeks to bring the two together through our concepts of design, practice and processes. We have clarified these points in the relevant sections of the paper. We have also reduced the number of references to the literature on the importance of power in understanding the dynamics of urban change.

Further development of the conclusions – Reviewer 1 asks if ULL can really 'govern' the city. We hope our perspective on governing is clear – that governing is a process accomplished through an array of interventions, programmes etc. that intervene in the urban arena with the intention of achieving particular ends. We further develop this argument in the conclusions and reflect that such intentions are no guarantee of success. From our perspective in this paper, what matters more is that ULL are becoming a means through which governing is being pursued rather than whether/not they are able to achieve their outcomes – this is material we are working on for other publications.

Revisiting the position of the Framework introduced in the conclusion – Reviewer 2 suggests that the framework is treated in rather cursory manner and on reflection we agree. Rather than presenting it as a fully worked through framework, given the constraints of the length of the paper, we have instead drawn out of the proceeding sections the importance of practice, processes and design as important components of how we understand the governing of transitions, and then used this to develop these three aspects as providing a new perspective on the role of ULL which we set out in the conclusion. We have removed reference to the future work.

Clarifying the substantive focus of ULL – Reviewer 1 helpfully makes a number of suggestions about the focus of ULLs (on place, on socio-ecological systems, as learning arenas). We have developed the introduction to ensure the strong link between place & ULL as well as ULL & 'triple helix' thinking is clear. We have replaced the term 'socio-technical' throughout with 'socio-material' to include socio-ecological systems, except where it refers to the analytical concept of socio-technical systems.

Rewriting the Abstract – Reviewer 2 suggested we rewrite the abstract to make the purpose of the paper clearer from the outset. We have provided a revised abstract accordingly.

Specific minor revisions – Reviewer 2 suggested we refer to a new book and that one sentence was confusing. We have included the book in our review of the literature and deleted the sentence.

Annotations – There are 32 references in the paper, 6 of which are now annotated.

Highlights:

- ULL are sites to design, test and learn from innovation in real time.
- ULL are proliferating rapidly while our understanding of their nature and purpose is still evolving.
- We seek to develop a theoretical framework on ULL by bringing governance thinking into transitions theory and vice versa.
- The framework helps identify shared concepts to inform the analysis of ULL in different contexts.
- Key framework elements are design, practices and processes of ULL.

Highlights:

- ULL are sites to design, test and learn from innovation in real time.
- ULL are proliferating rapidly while our understanding of their nature and purpose is still evolving.
- We seek to develop a new perspective on ULL by bringing governance thinking into transitions theory and vice versa.
- This perspective helps to identify shared concepts to inform the analysis of ULL in different contexts.
- The perspective demonstrates the roles of design, practices and processes of ULL in shaping their governance dynamics and transformative capacities.

Urban Living Labs: Governing Urban Sustainability Transitions

Harriet Bulkeley¹, Lars Coenen², Niki Frantzeskaki³, Christian Hartmann⁴, Annica Kronsell⁵, Simon Marvin⁶, Kes McCormick⁷, Frank van Steenbergen³, and Yuliya Voytenko⁷

- ¹ Durham University
- ² CIRCLE, Lund University
- ³ DRIFT, Erasmus University Rotterdam
- ⁴ Joanneum Research
- ⁵ Department of Political Science, Lund University
- ⁶ Sheffield University
- ⁷ IIIIEE, Lund University

Abstract: Urban Living Labs (ULL) are advanced as an explicit form of intervention delivering sustainability goals for cities. ULL are sites to design, test and learn from innovation in real time. They aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach and being open and participatory. While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. Drawing on transitions theory and urban governance and politics, we seek to shed light on ULL as part of this broad phenomenon by developing a perspective that brings governance thinking into transitions theory and vice versa. This paper focuses on core concerns within different approaches and the common ground they share as well as exploring important tensions. Through this process we develop a theoretical framework that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different contexts and conditions. We argue the key elements in such framework include the design, practices and processes of ULL.

Keywords: urban living labs, governance, urban sustainability, transitions

Highlights:

- ULL are sites to design, test and learn from innovation in real time.
- ULL are proliferating rapidly while our understanding of their nature and purpose is still evolving.
- We seek to develop a theoretical framework on ULL by bringing governance thinking into transitions theory and vice versa.
- The framework helps identify shared concepts to inform the analysis of ULL in different contexts.
- Key framework elements are design, practices and processes of ULL.

Introduction

Urban Living Labs are being advanced as an explicit form of intervention capable of delivering sustainability goals for cities. ULL are broadly conceived as forums “for innovation, applied to the development of new products, systems, services, and processes, employing working methods to integrate people into the entire development process as users and co-creators, to explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts” (JPI Urban Europe 2013). For those designing and implementing ULL, they are seen as a means through which to set up experiments and to trial innovations. They are purposefully intended to bring together multiple actors that seek to intervene in order to address contemporary sustainability challenges and foster learning through forms of open and engaged experimentation.

ULL aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach (Edwards-Schachter et al. 2012; Lehmann et al. 2015) and being open and participatory (Franz 2015). ULL are distinct in terms of their explicit place-based focus and their future-orientation, seeking to experiment today with solutions for the future. ULL seek to deliver innovative and transformative improvements across the urban milieu, from buildings to green space, transport to energy systems, local food to sustainable forms of consumption (Voytenko et al. 2015). In short, ULL are sites devised to design, test and learn from innovation in real time in order to respond to particular societal and environmental issues in a given urban place.

While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. In this paper, we position ULL as part of a broader shift in the nature of urban governance in which forms of innovation and experimentation are being marshalled as a means through which to govern particular (urban) conditions. ULL are not a stand-alone set of interventions, but part of a wider ‘politics of experimentation’ through which the governing of urban sustainability is increasingly taking place (Bulkeley et al. 2015; Frantzeskaki and Loorbach 2010; Franz 2015; McCormick et al. 2013; McGuirk et al. 2014; Wolfram and Frantzeskaki 2016). Drawing on the broad body of work on transitions theory and on urban governance and politics, we seek to develop a novel framework to critically understand the existing role and future potential of ULL as part of this broad phenomenon of urban experimentation. This paper therefore focuses on the core concerns within these two approaches, the common ground they share, and the important tensions. Through this process we develop a theoretical framework that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different urban contexts and local conditions.

Understanding ULL as Innovation Governance and Governance Innovation

As a means of intervening in the urban arena to address particular sustainability challenges, ULL constitute a particular form of governance innovation. Understanding the means through which they are designed, implemented and take effect can therefore usefully draw on the tradition of innovation studies and socio-technical transitions. This work has examined the role of niches that provide experimentation space for the development, testing and failure of novel innovations in ‘real’ contexts, where new networks can be supported and sustained (Smith and Raven 2012). These innovations struggle against stable regimes through which existing socio-technical systems are stabilised due to the processes of lock-in, path dependency

and 'entrapment' (Schot and Geels 2008; Grin et al. 2010). This work suggests that what is critical to the governance potential of ULL are the ways in which they constitute, and are constituted by, social networks, expectations or visions, and forms of learning. Niche experiments provide a space in which new ideas, ways of viewing the future, partnerships, socio-technical configurations and so on can be trialled in a 'protected' space, affording the actors involved the potential to go beyond business as usual and prove the potential of alternatives.

In the case of ULL, it is the focus on the creation of a new learning arena that marks out this particular type of governance innovation from other kinds of urban experimentation. Co-created by research organisations, public institutions, the private sector and community actors (Liedtke et al. 2012), ULL are seen as a means through which to gain experience, demonstrate, and test ideas, and co-develop new skills and actionable knowledge that is explicitly captured and used to inform the process of creating urban sustainability (Evans et al. 2015; Frantzeskaki and Kabisch 2016; Karvonen and van Heur 2014; Voytenko et al. 2015). In practice, the nature and extent of learning in ULL varies from those ULL which are highly-instrumented and seek to collect data in real-time, e.g. through 'smart' applications and data management and control systems, to those which regard learning as a collective and reflective practice, e.g. through ongoing forms of community and stakeholder engagement and consultation.

The extent to which the practices of learning, the social networks through which this is enabled, and the kinds of visions for urban sustainability that are designed and implemented through ULL, and the degree to which they are able to gain traction in the wider landscape has yet to be systematically analysed. Central to the analysis of niche innovations is a concern with their potential to transform wider systems. Smith and Raven (2012) argue that alongside processes of protection, niches and experiments foster different forms of empowerment – means through which they are able to either 'fit and conform' or 'stretch and reform' existing regimes. Our approach is to include a geographical perspective, which seeks to understand how the emergence of ULL under particular urban conditions is made possible and in turn changes the conditions of possibility for urban places – of what constitutes 'the regime'. This can contribute to our understanding of how ULL are formed and come to gain momentum, and in turn the ways in which this shapes their transformative potential.

Placing ULL within their wider context and seeking to analyse their consequences ensures that they are not considered only in their own terms – as a form of governance that may be more or less suited to specific contexts – but also in terms of their role as part of the wider phenomenon of a shift in the governance of sustainability. If urban sustainability used to be a matter of the development of urban plans and strategy, often informed by processes of environmental assessment and public consultation, ULL in common with other forms of experimentation involves a more interventionist, incremental and 'learning by doing' approach in which urban sustainability is emergent rather than pre-given. Yet, ULL, like all other interventions that seek to govern the urban condition in relation to a specific set of visions, entails the pursuit of some goals while others are sidelined. The ways in which ULL govern the urban arena has yet to be fully explored.

Governing the City through ULL

Understanding how ULL are becoming part of the urban governance landscape is a critical and emerging area of inquiry. There has, however, been a concern that the institutional and actor-orientation of the governance debate has backgrounded a set of key questions – how, by whom and with what consequences does governing take place? Therefore, the emphasis on analysing governance – as an institutional configuration – would benefit from an additional perspective that deals explicitly with governing – the means through which power and agency is orchestrated and takes effect. Such a combined approach would allow us to complement the identification of distinct spatial or temporal forms of governance with an examination of the means through which governing shapes societal transformation. In doing so, it helps to specify and unpack the causal mechanisms in these institutional configurations through which governing effectively takes place and through which we might seek both explanation and leverage to effect greater transformative potential (i.e. how and why such institutions effect the governing of innovation). Such an approach asks for a more vigorous interrogation of the ways in which power and agency are orchestrated to produce particular outcomes (and foreclose others). Such debates are of course long running in the social sciences and subject to sustained debate.

A central challenge is to provide an account that is able to deal with the stability of regimes and the dynamics of innovation. Initial attempts that have emphasised the structural power of regime formations and the agent-based power of innovations appear to have come full circle. Emphasising power as a property of individual agents neglects the structuring power of regimes. Focusing on power as a matter of interest neglects the long history of work in political science that has demonstrated the importance of ideas, values, and norms in shaping the dynamics of power. A human-centred vision of power (and agency) neglects the significant work of scholars in urban political ecology, actor-network theory and new materialism (much of which is concerned with questions of the urban and of infrastructure) in demonstrating the socio-material means through which power and agency are co-constituted and the importance of such perspectives in their emphasis on the political economies of infrastructure and metabolic flows (e.g. Bulkeley et al. 2015; Castán Broto and Bulkeley 2014; Desfor and Keil 2014; Evans 2011; Evans and Karvonen 2014; Hodson and Marvin 2010; Kaika 2005; Karvonen 2014; Graham and Marvin 2001; Maassen 2012; Monstadt 2009; Rutland and Aylett 2008; Swyngedouw and Heynen 2003; Swyngedouw 2010; Shove and Walker 2007).

One means of addressing this conceptual dilemma is to actively engage with the notion that power is a distributed property, such that it neither resides with individual agents nor is structurally determined (Ekers and Loftus 2008). Governing in such accounts is accomplished not by individual institutions, but is an active, dynamic and provisional process that is continually being sought through ‘programmes’ or ‘projects’ that seek to intervene in the existing social (and material) order to achieve particular ends (Bulkeley and Schroeder 2012). From these perspectives, power cannot be conceived as a held resource or property of individual actors. It is instead a relational force that emerges through the juncture of different configurations of social (and material) entities. This accords with Avelino (2011) that power is a capacity to mobilise, though it shifts away from the understanding that this capacity relates to a set of resources that are somehow outside of the socio-material relations within which power is generated.

1 Instead, it suggests that what constitutes a resource is itself realised through the
2 configuration of power. Agents and institutions are central to such an account of
3 power. Yet their nature, capacities and effects are not pre-given but rather generated
4 through the socio-material conditions within which power is realised. Governing from
5 such a perspective takes place through “strategically constructed concrete
6 programmes of action” by which the means of governing and the actors which enact
7 them are themselves constituted (McGuirk 2004). From this perspective, particular
8 projects of action – in our case ULL – can be seen as a manifestation of the ways in
9 which actors seek to constitute not only the world around them, but also what it
10 means to govern. ULL are then a calculated form of intervention. The nature and
11 effect of such interventions are constrained by the socio-technical configurations
12 within which they intervene and the power they generate in their assemblage,
13 whether it be of a particular modality (e.g. authority, domination, seduction, after Allen
14 (2003) or seen to have particular kinds of potential (e.g. innovative, transformative,
15 after Avelino (2014)).
16
17

18 **Conclusion**

19
20 Conceiving of ULL as particular governance projects provides one means through
21 which to conceptualise their role in transformative change. Taken together, this
22 reading of the literature on socio-technical transitions, power and governance
23 suggests that there is considerable scope to work with a notion of the governance of
24 transitions that pays attention to the dynamic qualities of power as a set of capacities
25 that are constituted through the formation of calculated interventions or projects
26 designed to intervene in the city in relation to particular goals which have some
27 degree of authority and legitimacy. Taking a view of power as a relational property
28 and manifest in the ways in which capacity is exercised suggests that investigating
29 how governing takes place requires an assessment of the ways in which ULL serve
30 to (re)configure socio-material conditions and mobilise agency and resources.
31
32
33

34 We suggest that such an approach requires the examination of how capacity to
35 govern is exercised in different arenas. Such an analysis involves attending not only
36 to what might appear to be the inherent capabilities or resources of organisations and
37 institutions (and from such descriptive accounts, reading off their power) but also
38 examining how the ULL intervention – its *design* – served to configure or reconfigure
39 the capacities, resources and agency of the actors, intermediaries and materialities
40 (e.g. the capacities of particular technologies, ecologies, or material properties of the
41 urban and how they are enrolled into strategic interventions) in particular urban
42 contexts and with what consequent effect. Following on we consider the design to
43 shape and form the *practices* and *processes* of ULL. Practices here comprise the
44 instruments (e.g. policy tools, incentives, consultation deployed) and techniques (e.g.
45 forms of learning, measurement, accountability used). Processes are the means
46 through which elements of the ULL are mobilised and transformed beyond the initial
47 site and objectives of intervention.
48
49
50

51 Utilizing this framework in our comparative work on ULL across different European
52 urban contexts is starting to reveal important insights into the heterogeneity and
53 diversity of these forms of urban experiment. For instance the design of laboratories
54 varies significantly across three types of ULL: ‘strategic’ responses, often with strong
55 state private funding that structure the urban context as a site for experimentation;
56 ‘civic’ responses, often with municipalities and universities as key actors with other
57 social interests focused on economic growth and sustainability; and ‘organic’
58 responses, often with NGOs and civil society based on diverse local priorities. Each
59
60
61
62
63
64
65

of these responses is configured through quite different sets of practices and processes producing distinctive and often disconnected landscapes of ULL within a particular urban context. Further detailed empirical work is exploring the extent to which these diverse responses achieve their intended impacts but also we want to explore what unintended consequences these might produce in shaping urban sustainability transitions.

Acknowledgements

The authors acknowledge the support of JPI Urban Europe for the Governance of Urban Sustainability Transitions (GUST) project.

References

- Allen, J. 2003. "Power as an Immanent Affair: Foucault and Deleuze's Topological Detail." In *Lost Geographies of Power*, 65–91. Blackwell Publishing.
- Avelino, F. 2011. "Power in Transition: Empowering Discourses on Sustainability Transitions." PhD thesis, Rotterdam: Erasmus University Rotterdam. <http://repub.eur.nl/pub/30663/>.
- Avelino, F. 2014. "Power-in-Transition: Reconstructing Power Dynamics in Sustainability." presented at the Anniversary MSc Environmental Governance (MEG), Public Lecture Series "Sustainability – Power and Change," Freiburg, November 28.
- Bulkeley, H., G. Powells, and S. Bell. 2015. "Smart Grids and the Constitution of Solar Electricity Conduct." *Environment and Planning A*, August, 0308518X15596748. doi:10.1177/0308518X15596748.
- Bulkeley, H. and H. Schroeder. 2012. In *Handbook of Global Environmental Politics, Second Edition*, edited by Peter Dauvergne. Cheltenham: Edward Elgar Publishing. <http://www.elgaronline.com/view/9781849809405.xml>.
- Castán Broto, V., and H. Bulkeley. 2014. "Maintaining Experiments and the Material Agency of the Urban." In *Infrastructural Lives: Urban Infrastructure in Context*, edited by S. Graham and C. McFarlane. London and New York: Earthscan from Routledge.
- Desfor, G., and R. Keil. 2014. *Nature and the City: Making Environmental Policy in Toronto and Los Angeles*. Tucson, Arizona: University of Arizona Press. <http://www.uapress.arizona.edu/Books/bid1578.htm>.
- Edwards-Schachter, M. E., C. E. Matti, and E. Alcántara. 2012. "Fostering Quality of Life through Social Innovation: A Living Lab Methodology Study Case." *Review of Policy Research* 29 (6): 672–92. doi:10.1111/j.1541-1338.2012.00588.x.
- Ekers, M. and A. Loftus. 2008. "The Power of Water: Developing Dialogues between Foucault and Gramsci." *Environment and Planning D: Society and Space* 26 (4): 698–718. doi:10.1068/d5907.
- Evans, J. 2011. "Resilience, Ecology and Adaptation in the Experimental City." *Transactions of the Institute of British Geographers* 36 (2): 223–37. doi:10.1111/j.1475-5661.2010.00420.x.
- Evans, J., R. Jones, A. Karvonen, L. Millard, and J. Wendler. 2015. "Living Labs and Co-Production: University Campuses as Platforms for Sustainability Science." *Current Opinion in Environmental Sustainability*, Sustainability science, 16 (October): 1–6. doi:10.1016/j.cosust.2015.06.005.
- Evans, J. and A. Karvonen. 2014. "'Give Me a Laboratory and I Will Lower Your Carbon Footprint!' — Urban Laboratories and the Governance of Low-Carbon Futures." *International Journal of Urban and Regional Research* 38 (2): 413–30. doi:10.1111/1468-2427.12077.
- Frantzeskaki, N. and N. Kabisch. 2016. "Designing a knowledge co-production space for urban environmental governance." *Environmental science and policy*. doi:10.1016/j.envsci.2016.01.010
- Frantzeskaki, N., and D. Loorbach. 2010. "Towards Governing Infrasystem Transitions, Reinforcing Lock-in or Facilitating Change?" *Technological Forecasting and Social Change* 77 (8): 1292–1301.
- Franz, Y. 2015. "Designing Social Living Labs in Urban Research." *Emerald Insight* 17 (4): 53–66. doi:10.1108/info-01-2015-0008.

- Graham, S. and S. Marvin. 2001. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. London and New York: Routledge.
- Grin, J., J. Rotmans, and J. Schot. 2010. *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*. London: Routledge.
- Hodson, M. and S. Marvin. 2010. "Can Cities Shape Socio-Technical Transitions and How Would We Know If They Were?" *Research Policy*, no. 39: 477–85.
- JPI Urban Europe. 2013. "Urban Europe: Creating Attractive, Sustainable and Economically Viable Urban Areas. 2nd Joint Call for Proposals." Joint Programming Initiative Urban Europe. file:///C:/Users/iie-yve/Downloads/Full-proposal-stage-Call-Text-2013.pdf.
- Kaika, M. 2005. *City of Flows: Modernity, Nature, and the City*. London and New York: Routledge.
- Karvonen, A. 2014. "Pathways of Urban Nature: Diversity in the Greening of the Twenty-First-Century City." In *Now Urbanism: The Future City Is Here*, edited by J. Hou, B. Spencer, T. Way, and K. Yocom. London: Routledge.
- Karvonen, A. and B. van Heur. 2014. "Urban Laboratories: Experiments in Reworking Cities." *International Journal of Urban and Regional Research* 38 (2): 379–92. doi:10.1111/1468-2427.12075.
- Lehmann, V., M. Frangioni, and P. Dubé. 2015. "Living Lab as Knowledge System: An Actual Approach for Managing Urban Service Projects?" *Journal of Knowledge Management* 19 (5): 1087–1107. doi:10.1108/JKM-02-2015-0058.
- Liedtke, C., M. Welfens, H. Rohn, and J. Nordmann. 2012. "LIVING LAB : User-Driven Innovation for Sustainability." *International Journal of Sustainability in Higher Education* 13 (2): 106–18.
- Maassen, A. 2012. "Heterogeneity of Lock-In and the Role of Strategic Technological Interventions in Urban Infrastructural Transformations." *European Planning Studies* 20 (3): 441–60. doi:10.1080/09654313.2012.651807.
- McCormick, K., S. Anderberg, L. Coenen, and L. Neij. 2013. "Advancing Sustainable Urban Transformation." *Journal of Cleaner Production*, no. 50: 1–11.
- McGuirk, P. M. 2004. "State, Strategy, and Scale in the Competitive City: A Neo-Gramscian Analysis of the Governance of 'Global Sydney.'" *Environment and Planning A* 36 (6): 1019–43. doi:10.1068/a36131.
- McGuirk, P. M., H. Bulkeley, and R. Dowling. 2014. "Practices, Programs and Projects of Urban Carbon Governance: Perspectives from the Australian City." *Geoforum* 52 (March): 137–47. doi:10.1016/j.geoforum.2014.01.007.
- Monstadt, J. 2009. "Conceptualizing the Political Ecology of Urban Infrastructures: Insights from Technology and Urban Studies." *Environment and Planning A* 41 (8): 1924–42. doi:10.1068/a4145.
- Rutland, T. and A. Aylett. 2008. "The Work of Policy: Actor Networks, Governmentality, and Local Action on Climate Change in Portland, Oregon." *Environment and Planning D: Society and Space* 26 (4): 627–46. doi:10.1068/d6907.
- Schot, J., and F.W. Geels. 2008. "Strategic Niche Management and Sustainable Innovation Journeys: Theory, Findings, Research Agenda, and Policy." *Technology Analysis & Strategic Management* 20 (5): 537–54.
- Shove, E. and G. Walker. 2007. "CAUTION! Transitions Ahead: Politics, Practice and Sustainable Transition Management." *Environment and Planning A* 39: 763–70.

- 1 Smith, A. and R. Raven. 2012. "What Is Protective Space? Reconsidering Niches in
2 Transitions to Sustainability." *Research Policy* 41: 1025–36.
- 3 Swyngedouw, E. and N.C. Heynen. 2003. "Urban Political Ecology in Advanced
4 Capitalist Countries." *Antipode: A Journal of Radical Geography* 35 (5): 898–
5 918.
- 6 Swyngedouw, E. 2010. "Impossible Sustainability and the Post-Political Condition." In
7 *Making Strategies in Spatial Planning*, edited by Maria Cerreta, Grazia
8 Concilio, and Valeria Monno, 185–205. Urban and Landscape Perspectives 9.
9 Springer Netherlands. [http://link.springer.com/chapter/10.1007/978-90-481-](http://link.springer.com/chapter/10.1007/978-90-481-3106-8_11)
10 [3106-8_11](http://link.springer.com/chapter/10.1007/978-90-481-3106-8_11).
- 11 Voytenko, Y., K. McCormick, J. Evans, and G. Schliwa. 2015. "Urban Living Labs for
12 Sustainability and Low Carbon Cities in Europe: Towards a Research
13 Agenda." *Journal of Cleaner Production*, no. In Press.
14 doi:10.1016/j.jclepro.2015.08.053.
- 15 Wolfram, M. and N. Frantzeskaki. 2016. "Cities and Systemic Change for
16 Sustainability: Prevailing Epistemologies and an Emerging Research Agenda."
17 *Sustainability* 8 (2): 144. doi:10.3390/su8020144.
- 18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65

Urban Living Labs: Governing Urban Sustainability Transitions

Harriet Bulkeley¹, Lars Coenen², Niki Frantzeskaki³, Christian Hartmann⁴, Annica Kronsell⁵, [Lindsay Mai¹](#), Simon Marvin⁶, Kes McCormick⁷, Frank van Steenbergen³, and Yuliya Voytenko [Palgan⁷](#)

¹ Durham University
² CIRCLE, Lund University
³ DRIFT, Erasmus University Rotterdam
⁴ Joanneum Research
⁵ Department of Political Science, Lund University
⁶ Sheffield University
⁷ IIIIEE, Lund University

Abstract: Urban Living Labs (ULL) are advanced as an explicit form of intervention delivering sustainability goals for cities. Established at the boundaries between research, innovation and policy, ULL are sites teintended to design, test demonstrate and learn from innovation in about the effects of a range of urban interventions in real time. They aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach and being open and participatory. While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. While much of the existing literature draws attention to the aims and workings of ULL, there have to date been fewer critical accounts that seek to understand their purpose within the shifting landscape of urban development. In this paper, we suggest that transitions studies and the literature on urban governance offer important insights that can enable us to address this gap. We illustrate how insights from transition studies can inform us about the role of ULL as ‘niches’ within wider urban regimes and the kinds of dynamics that are important to their success (and failure). We suggest that the debate on urban governance can provide us with a perspective that takes into account not only the institutional arrangements through which ULL are pursued, but to more fundamental questions about the capacities they enable through creating new forms of power and agency. Armed with these insights, we conclude that work on ULL needs to account for how they are designed or configured, the practices they undertake, as well as the processes through which they seek to foster broader urban transformation. ~~Drawing on transitions theory and urban governance and politics, we seek to shed light on ULL as part of this broad phenomenon by developing a perspective that brings governance thinking into transitions theory and vice versa. This paper focuses on core concerns within different approaches and the common ground they share as well as exploring important tensions. Through this process we develop a theoretical framework that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different contexts and conditions. We argue the key elements in such framework include the design, practices and processes of ULL.~~

Keywords: urban living labs, governance, urban sustainability, transitions

Highlights:

- ULL are sites to design, test and learn from innovation in real time.
- ULL are proliferating rapidly while our understanding of their nature and purpose is still evolving.

- We seek to develop a ~~theoretical framework~~new perspective on ULL by bringing governance thinking into transitions theory and vice versa.
- ~~The framework~~This perspective helps to identify shared concepts to inform the analysis of ULL in different contexts.
- ~~Key framework elements are~~The perspective demonstrates the roles of design, practices and processes of ULL in shaping their governance dynamics and transformative capacities.

Introduction

Urban Living Labs (ULL) are being advanced as an explicit form of intervention capable of delivering sustainability goals for cities. ULL ~~are~~ can be broadly conceived as forums “for innovation, applied to the development of new products, systems, services, and processes, employing working methods to integrate people into the entire development process as users and co-creators, to explore, examine, experiment, test and evaluate new ideas, scenarios, processes, systems, concepts and creative solutions in complex and real contexts” (JPI Urban Europe 2013). For those designing and implementing ULL, they are seen as a means through which to set up ~~experiments~~ demonstration and to trial ~~innovations~~ different kinds of intervention in the city, from relatively simple technical innovations to more complex or integrated measures designed to contribute to urban social and economic development and wider goals of sustainability. They are purposefully intended to bring together multiple actors—that seek to intervene in order to address contemporary ~~sustainability~~ urban challenges and foster learning through forms of open and engaged experimentation.

What makes ULL distinct is their focus on knowledge and learning as a means through which such interventions can be successfully achieved. ULL aim at co-creation and empowerment of multiple stakeholders in co-shaping of the experimental approach in a ‘triple’ or ‘quadruple’ helix mode of bringing science, policy, business and civil society together (Edwards-Schachter et al. 2012; Lehmann et al. 2015) and being open and participatory (Franz 2015). ULL are ~~distinct in also~~ marked by terms of their explicit place-based focus, whether this be concerned with a specific urban site, district or economy and their future-orientation, seeking to experiment today with solutions for the future. ULL seek to deliver innovative and transformative improvements across the urban milieu, from buildings to green space, transport to energy systems, local food to sustainable forms of consumption (Voytenko et al. 2015). They work within and across urban socio-technical and socio-ecological systems in order to mobilise change. In short, ULL are sites devised to design, test and learn from innovation in real time in order to respond to particular societal, economic and environmental issues in a given urban place (McCormick and Kiss 2015).

While rapidly growing as an empirical phenomenon, our understanding of the nature and purpose of ULL is still evolving. There are a growing number of accounts of ULL derived from actors who have been involved in establishing ULL or in undertaking analysis of how they have been established and the extent to which they are fulfilling their intended purposes of testing, learning and developing innovation. Given the early stages of the development of ULL, this material tends to primarily be in the grey literature with fewer academic papers having been written to date (though for recent examples see: Evans 2016; Karvonen and van Heur 2014). There have been fewer perspectives to date that have taken a more critical approach to the analysis of ULL, seeking to investigate the emergence and embedding of this phenomenon within broader logics of urban development and examining their consequences and implications (for a recent and comprehensive exception, see: Evans et al. 2016).

In this paper, we seek to address this gap by positioning ULL as part of a broader shift in the nature of urban governance in which forms of innovation and experimentation are being marshalled as a means through which to govern particular (urban) conditions (Bulkeley and Castan Broto 2013). We suggest that ULL are not a stand-alone set of interventions, but part of a wider ‘politics of experimentation’

through which the governing of urban sustainability is increasingly taking place (Bulkeley et al. 2015; Evans et al. 2016; Frantzeskaki and Loorbach 2010; Franz 2015; McCormick et al. 2013; McGuirk et al. 2014; Wolfram and Frantzeskaki 2016). While they may be distinct in terms of their concern with the use of data and real-time knowledge in order to generate insight and traction for the forms of intervention they are undertaking, here our focus is not on their capacities to develop learning per se but rather with how they contribute to the emergent experimental approach to responding to sustainability challenges at the urban level. This raises the question if and how such an experimental approach can create an impact beyond their immediate domain and induce transitions across urban socio-technical and socio-ecological systems. A crucial challenge in this regard is how loosely coupled system elements (new technologies, institutions, markets, actor and network constellations) evolve and align into more stable configurations that would be able to replace and transform a current (unsustainable) system.

It has been within the fields of transitions theory and urban governance that the nature and dynamics of urban experimentation has been most closely studied to date. We draw on these broad bodies of work—Drawing on the broad body of work on transitions theory and on urban governance and politics, we seek—to develop a novel framework to critically understand the existing role and future potential of ULL as part of this broad phenomenon of urban experimentation. This paper therefore focuses on the core concerns within these two approaches, the common ground they share, and the important tensions. Through this process we develop a theoretical framework new perspective that can identify a shared set of concepts and issues to inform the investigation and analysis of ULL in different urban contexts and local conditions.

Understanding ULL as Innovation Governance and Governance Innovation

As a means of intervening in the urban arena to address particular sustainability challenges, ULL constitute a particular form of governance innovation. Understanding the means through which they are designed, implemented and take effect can therefore usefully draw on the tradition of innovation studies and socio-technical transitions. This work has examined the role of niches that provide experimentation space for the development, testing and failure of novel innovations in ‘real’ contexts, where new networks can be supported and sustained (Smith and Raven 2012). These innovations struggle against stable regimes through which existing socio-technical systems are stabilised due to the processes of lock-in, path dependency and ‘entrapment’ (Schot and Geels 2008; Grin et al. 2010). This work suggests that what is critical to the governance potential of ULL are the ways in which they constitute, and are constituted by, social networks, expectations or visions, and forms of learning. The configuration or design of nNiche experiments provides a space in which new ideas, ways of viewing the future, partnerships, socio-~~technical-material~~ configurations and so on can be trialled in a ‘protected’ space, affording the actors involved the potential to go beyond business as usual and prove the potential of alternatives.

In the case of ULL, as discussed above, it is the focus on the creation of a new learning arena that marks out this particular type of governance innovation from other kinds of urban experimentation. Co-created by research organisations, public institutions, the private sector and community actors in what is often referred to as a ‘triple’ or ‘quadruple’ helix mode (Liedtke et al. 2012), ULL are seen as a means through which to gain experience, demonstrate, and test ideas, and co-develop new skills and actionable knowledge that is explicitly captured and used to inform the

process of creating urban sustainability (Evans et al. 2015; Frantzeskaki and Kabisch 2016; Karvonen and van Heur 2014; Voytenko et al. 2015). In some contexts, such as the development of projects under the JPI Urban Europe Programme, the development of ULL draws explicitly on the learning gained from approaches to transition management in which research teams, together with stakeholders, are actively engaged in fostering the ULL and leading a process of visioning and learning through which transitions in urban practice, policies and planning can take place. In practice Elsewhere, the nature and extent of learning in ULL varies from those ULL which are highly-instrumented and seek to collect data in real-time, e.g. through 'smart' applications and data management and control systems, to those which regard learning as a collective and reflective practice, e.g. through ongoing forms of community and stakeholder engagement and consultation. The different practices which animate ULL are critical in shaping how these interventions in turn are able to gain traction and realise their objectives for governing the city.

~~The extent to which the practices of learning, the social networks through which this is enabled, and the kinds of visions for urban sustainability that are designed and implemented through ULL, and the degree to which they are able to gain traction in the wider landscape has yet to be systematically analysed.~~ Beyond questions of the social networks and visions that constitute how ULL are configured and the practices of learning through which they are enacted, Central to the analysis of niche innovations is a concern with their potential to transform wider systems. Smith and Raven (2012) argue that alongside processes of protection, niches and experiments foster different forms of empowerment – means through which they are able to either 'fit and conform' or 'stretch and reform' existing regimes. Our approach is to include a including a geographical perspective, which seeks to understand how the emergence of ULL under particular urban conditions is made possible and in turn changes the conditions of possibility for urban places, is critical for developing our understanding of the processes through which ULL are (and are not) able to leverage change within and across the urban arena (Truffer et al. 2015) – of what constitutes 'the regime'. This can In short, integrating insights from the growing body of work on the geographies of niche innovations and transitions can contribute to our understanding of how the processes through which ULL are formed and come to ULL come to gain momentum, and in turn the ways in which this shapes their transformative potential.

Transition studies perspectives therefore provide a great deal of insight into how ULL, as a form of niche innovation or as a process through which transition management is deployed, are governed. It signals the importance of the visions, knowledge, skills and social networks designed into ULL, the practices through which learning is enabled, and the processes through which broader transformation is sought. However, it is critical that ULL are not considered only in their own terms – as a form of governance intervention that may be more or less suited to specific contexts – but also in terms of their role as part of the wider phenomenon of a shift in the governance of sustainability. It is to these debates that we now turn. If urban sustainability used to be a matter of the development of urban plans and strategy, often informed by processes of environmental assessment and public consultation, ULL in common with other forms of experimentation involves a more interventionist, incremental and 'learning by doing' approach in which urban sustainability is emergent rather than pre-given. Yet, ULL, like all other interventions that seek to govern the urban condition in relation to a specific set of visions, entails the pursuit of

some goals while others are sidelined. The ways in which ULL govern the urban arena has yet to be fully explored.

Governing the City through ULL

If governing urban sustainability used to be a matter of the development of urban plans and strategy, often informed by processes of environmental assessment and public consultation, ULL in common with other forms of experimentation involves a more interventionist, incremental and 'learning by doing' governing approach in which urban sustainability is emergent rather than pre-given. Seeing ULL not only as discrete arenas for research and development, but as part of a broader shift in the ways in which society responds to urban sustainability challenges requires a more explicit engagement with the ways in which they form part of the shifting governance landscape. Within the transitions studies field,

Understanding how ULL are becoming part of the urban governance landscape is a critical and emerging area of inquiry. There has, however, been a concern that the institutional and actor-orientation of the governance debate has backgrounded a set of key questions – how, by whom and with what consequences does governing take place?

We suggest that in seeking to understand the nature and dynamics of governing urban transitions through ULL, ~~Therefore, the~~ this emphasis on analysing governance – as an institutional configuration – would benefit from an additional perspective that deals explicitly with governing – the means through which power and agency is orchestrated and takes effect ([see also Raven et al. \(2016\) for a similar argument in relation to niche governance](#)). Such a combined approach ~~would allow~~ enables us to complement the identification of distinct spatial or temporal forms of governance with an examination of the means through which governing shapes societal transformation. In doing so, it helps to specify and unpack the causal mechanisms in these institutional configurations through which governing effectively takes place and through which we might seek both explanation and leverage to effect greater transformative potential (i.e. how and why such institutions effect the governing of innovation). Such an approach asks for a more vigorous interrogation of the ways in which power and agency are orchestrated to produce particular outcomes (and foreclose others). Such debates are of course long running in the social sciences and subject to sustained debate.

A central challenge is to provide an account that is able to deal with the stability of regimes and the dynamics of innovation. Initial attempts that have emphasised the structural power of regime formations and the agent-based power of innovations appear to have come full circle. Emphasising power as a property of individual agents neglects the structuring power of regimes. Focusing on power as a matter of interest neglects the long history of work in political science that has demonstrated the importance of ideas, values, and norms in shaping the dynamics of power. A human-centred vision of power (and agency) neglects the significant work of scholars in urban political ecology, actor-network theory and new materialism (much of which is concerned with questions of the urban and of infrastructure) in demonstrating the socio-material means through which power and agency are co-constituted and the importance of such perspectives in their emphasis on the political economies of infrastructure and metabolic flows (e.g. Bulkeley et al. 2015; ~~Castán Broto and Bulkeley 2014; Desfor and Keil 2014;~~ Evans 2011; Evans and Karvonen 2014; Hodson and Marvin 2010; ~~Kaika 2005; Karvonen 2014; Graham and Marvin 2001;~~

Maassen 2012; Monstadt 2009; ~~Rutland and Aylett 2008~~; Swyngedouw and Heynen 2003; Swyngedouw 2010; Shove and Walker 2007).

One means of addressing this conceptual dilemma is to actively engage with the notion that power is a distributed property, such that it neither resides with individual agents nor is structurally determined (Ekers and Loftus 2008). Governing in such accounts is accomplished not by individual institutions, but is an active, dynamic and provisional process that is continually being sought through 'programmes' or 'projects' that seek to intervene in the existing social (and material) order to achieve particular ends (McGuirk et al. 2016) (~~Bulkeley and Schroeder 2012~~). From these perspectives, power cannot be conceived as a held resource or property of individual actors. It is instead a relational force that emerges through the juncture of different configurations of social (and material) entities (see also Avelino 2011). ~~This accords with Avelino (2011) that power is a capacity to mobilise, though it shifts away from the understanding that this capacity relates to a set of resources that are somehow outside of the socio-material relations within which power is generated.~~

~~Instead, it suggests that what constitutes a resource is itself realised through the configuration of power.~~ Agents and institutions are central to such an account of power. Yet their nature, capacities and effects are not pre-given but rather generated through the socio-material conditions within which power is realised. Governing from such a perspective takes place through "strategically constructed concrete programmes of action" by which the means of governing and the actors which enact them are themselves constituted (McGuirk 2004). From this perspective, particular projects of action – in our case ULL – can be seen as a manifestation of the ways in which actors seek to constitute not only the world around them, but also what it means to govern. The design of ULL is then central to their capacities as are then a calculated form of intervention. The nature and effect of such interventions are constrained by the socio-~~material~~technical configurations within which they intervene and the power they generate in their assemblage, whether it be of a particular modality (e.g. authority, domination, seduction, after Allen (2003) or seen to have particular kinds of potential (e.g. innovative, transformative, after Avelino (2014). This in turn suggests that the ways in which ULL are conducted – the techniques of data gathering, the forms of participation – are a critical means through which the governing of the urban milieu takes place. In short, that the practices commonly associated with ULL's – of partnership, participation, learning, data mining etc. – are not neutral mechanisms but central to the ways in which governing is achieved and in shaping the possibilities for transformative processes.

Conclusion

Conceiving of ULL as particular governance projects provides one means through which to conceptualise their role in transformative change. Taken together, this reading of the literature on ~~socio-technical~~ transitions, power and governance suggests that there is considerable scope to work with a notion of the governance of transitions that pays attention to the dynamic qualities of power as a set of capacities that are constituted through the formation of calculated interventions or projects designed to intervene in the city in relation to particular goals which have some degree of authority and legitimacy. Taking a view of power as a relational property and manifest in the ways in which capacity is exercised suggests that investigating how governing takes place ~~requires an assessment of the ways in which through~~ requires that we move beyond understanding them only as a means through which new kinds of research, development and learning are being orchestrated towards an

assessment of how they serve to (re)configure socio-material conditions and mobilise agency and resources.

We suggest that such an approach requires the examination of how capacity to govern is exercised in different arenas. Such an analysis involves attending not only to what might appear to be the inherent capabilities or resources of organisations and institutions (and from such descriptive accounts, reading off their power) but also examining how the ULL intervention ~~—its design—~~served to configure or reconfigure the capacities, resources and agency of the actors, intermediaries and materialities (e.g. the capacities of particular technologies, ecologies, or material properties of the urban and how they are enrolled into strategic interventions) in particular urban contexts and with what consequent effect. In short, that what ULL's are capable of is not only a matter of the institutions and actors involved, but how their configuration or design realises new kinds of capacities and capabilities. Following on we consider the design to shape and form

This in turn shapes the practices that are undertaken within ULL, including the ~~and processes of ULL. Practices here comprise the~~ instruments (e.g. policy tools, incentives, consultation deployed) and techniques (e.g. forms of learning, measurement, accountability) used. These practices can both serve to reinforce the configuration of the ULL but also create new junctures and configurations through which the ULL may evolve in its intentions and capacities}. The ability for any particular ULL to realize a broader set of transformations. Processes are the means through which elements of the ULL are mobilised and transformed beyond the initial site and objectives of intervention relies on a series of processes, including learning, mobilization and translation, which are made more or less possible and feasible by both the design of the initial intervention and the practices to which it gives rise.

From our analysis of the insights given by transition studies and urban governance, we find that these three elements – the design, practices and processes – of ULL are critical in terms of understanding their role in governing urban development and contributing to social and environmental transformation. In this perspective, ULL are doing more than simply fostering learning and innovation, they are part of the ways in which urban responses to sustainability challenges are governed. Viewing ULL as part of the shifting governance landscape, a means through which interventions are increasingly pursued in order to realize urban objectives, does not mean that they are all equally successful in realizing their aims. Understanding how and why some ULL are able to take effect and others are not requires that we delve into these dynamics of power and agency to grapple with how the governing of the city is taking place. Using this perspective, we suggest that further detailed empirical work is required to explore the extent to which these diverse responses achieve their intended impacts and the unintended consequences these might produce in shaping urban sustainability transitions.

~~Utilizing this framework in our comparative work on ULL across different European urban contexts is starting to reveal important insights into the heterogeneity and diversity of these forms of urban experiment. For instance the design of laboratories varies significantly across three types of ULL: 'strategic' responses, often with strong state private funding that structure the urban context as a site for experimentation; 'civic' responses, often with municipalities and universities as key actors with other social interests focused on economic growth and sustainability; and 'organic' responses, often with NGOs and civil society based on diverse local priorities. Each of these responses is configured through quite different sets of practices and~~

~~processes producing distinctive and often disconnected landscapes of ULL within a particular urban context. Using this persepective, we suggest that f~~Further detailed empirical work is exploring required to explore the extent to which these diverse responses achieve their intended impacts but also we want to explore what and the unintended consequences these might produce in shaping urban sustainability transitions.

Acknowledgements

The authors acknowledge the support of JPI Urban Europe for the Governance of Urban Sustainability Transitions (GUST) project.

References

- Allen, J. 2003. "Power as an Immanent Affair: Foucault and Deleuze's Topological Detail." In *Lost Geographies of Power*, 65–91. Blackwell Publishing.
- Avelino, F. 2011. "Power in Transition: Empowering Discourses on Sustainability Transitions." PhD thesis, Rotterdam: Erasmus University Rotterdam. <http://repub.eur.nl/pub/30663/>.
- Avelino, F. 2014. "Power-in-Transition: Reconstructing Power Dynamics in Sustainability." presented at the Anniversary MSc Environmental Governance (MEG), Public Lecture Series "Sustainability – Power and Change," Freiburg, November 28.
- Bulkeley, H., G. Powells, and S. Bell. 2015. "Smart Grids and the Constitution of Solar Electricity Conduct." *Environment and Planning A*, August, 0308518X15596748. doi:10.1177/0308518X15596748.
- Bulkeley, H. and Castan-Broto, V.C. (2013). Government by experiment? Global cities and the governing of climate change. *Transactions. Institute of British Geographers* 38, pp. 361–375.
- ~~Bulkeley, H. and H. Schroeder. 2012. In *Handbook of Global Environmental Politics, Second Edition*, edited by Peter Dauvergne. Cheltenham: Edward Elgar Publishing. <http://www.elgaronline.com/view/9781849809405.xml>.~~
- ~~Gastán Broto, V., and H. Bulkeley. 2014. "Maintaining Experiments and the Material Agency of the Urban." In *Infrastructural Lives: Urban Infrastructure in Context*, edited by S. Graham and C. McFarlane. London and New York: Earthscan from Routledge.~~
- ~~Desfor, G., and R. Keil. 2014. *Nature and the City: Making Environmental Policy in Toronto and Los Angeles*. Tucson, Arizona: University of Arizona Press. <http://www.uapress.arizona.edu/Books/bid1578.htm>.~~
- Edwards-Schachter, M. E., C. E. Matti, and E. Alcántara. 2012. "Fostering Quality of Life through Social Innovation: A Living Lab Methodology Study Case." *Review of Policy Research* 29 (6): 672–92. doi:10.1111/j.1541-1338.2012.00588.x.
- Ekers, M. and A. Loftus. 2008. "The Power of Water: Developing Dialogues between Foucault and Gramsci." *Environment and Planning D: Society and Space* 26 (4): 698–718. doi:10.1068/d5907.
- * Evans, J. 2016. Trials and Tribulations: Problematizing the City through/as Urban Experimentation, *Geography Compass* 10/10 (2016): 429–443,
- "A concise review of the debate on the experimental city, the article examines the rise of this phenomenon in the domains of urban economic and sustainable development. A very good introductory text."
- * Evans, J., Karvonen, A. and Raven, R. (Eds.) (2016) *The Experimental City: new modes and prospects of urban transformation*. Routledge, London.
- "The first edited collection to investigate the phenomenon of the growth of experimentation as a form of urban governance, this collection brings together different theoretical perspectives and detailed empirical examples across a range of different urban contexts. Includes specific chapters of ULL but primarily related to the wider phenomenon of urban experimentation."
- Evans, J. 2011. "Resilience, Ecology and Adaptation in the Experimental City." *Transactions of the Institute of British Geographers* 36 (2): 223–37. doi:10.1111/j.1475-5661.2010.00420.x.

* Evans, J., R. Jones, A. Karvonen, L. Millard, and J. Wendler. 2015. "Living Labs and Co-Production: University Campuses as Platforms for Sustainability Science." *Current Opinion in Environmental Sustainability*, Sustainability science, 16 (October): 1–6. doi:10.1016/j.cosust.2015.06.005.

"This paper discusses the potential of living labs to provide a holistic and iterative framework for the co-production of knowledge."

Evans, J. and A. Karvonen. 2014. "Give Me a Laboratory and I Will Lower Your Carbon Footprint!" — Urban Laboratories and the Governance of Low-Carbon Futures." *International Journal of Urban and Regional Research* 38 (2): 413–30. doi:10.1111/1468-2427.12077.

* Frantzeskaki, N. and N. Kabisch. 2016. "Designing a knowledge co-production space for urban environmental governance." *Environmental science and policy*. doi:10.1016/j.envsci.2016.01.010

"A comparative assessment of the way policy-science dialogues have achieved knowledge co-production about strategic urban environmental governance action. Very relevant to the ULL approach."

Frantzeskaki, N., and D. Loorbach. 2010. "Towards Governing Infrasystem Transitions, Reinforcing Lock-in or Facilitating Change?" *Technological Forecasting and Social Change* 77 (8): 1292–1301.

Franz, Y. 2015. "Designing Social Living Labs in Urban Research." *Emerald Insight* 17 (4): 53–66. doi:10.1108/info-01-2015-0008.

~~Graham, S. and S. Marvin. 2001. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. London and New York: Routledge.~~

Grin, J., J. Rotmans, and J. Schot. 2010. *Transitions to Sustainable Development: New Directions in the Study of Long Term Transformative Change*. London: Routledge.

Hodson, M. and S. Marvin. 2010. "Can Cities Shape Socio-Technical Transitions and How Would We Know If They Were?" *Research Policy*, no. 39: 477–85.

JPI Urban Europe. 2013. "Urban Europe: Creating Attractive, Sustainable and Economically Viable Urban Areas. 2nd Joint Call for Proposals." Joint Programming Initiative Urban Europe. file:///C:/Users/iiie-yve/Downloads/Full-proposal-stage-Call-Text-2013.pdf.

~~Kaika, M. 2005. *City of Flows: Modernity, Nature, and the City*. London and New York: Routledge.~~

Karvonen, A. 2014. "Pathways of Urban Nature: Diversity in the Greening of the Twenty-First-Century City." In *Now Urbanism: The Future City Is Here*, edited by J. Hou, B. Spencer, T. Way, and K. Yocom. London: Routledge.

* Karvonen, A. and B. van Heur. 2014. "Urban Laboratories: Experiments in Reworking Cities." *International Journal of Urban and Regional Research* 38 (2): 379–92. doi:10.1111/1468-2427.12075.

"A review of laboratories and practices of experimentation over the past three decades to understand the significance of these spaces of experimentation in urban contexts."

Lehmann, V., M. Frangioni, and P. Dubé. 2015. "Living Lab as Knowledge System: An Actual Approach for Managing Urban Service Projects?" *Journal of Knowledge Management* 19 (5): 1087–1107. doi:10.1108/JKM-02-2015-0058.

Liedtke, C., M. Welfens, H. Rohn, and J. Nordmann. 2012. "LIVING LAB : User-Driven Innovation for Sustainability." *International Journal of Sustainability in Higher Education* 13 (2): 106–18.

- Maassen, A. 2012. "Heterogeneity of Lock-In and the Role of Strategic Technological Interventions in Urban Infrastructural Transformations." *European Planning Studies* 20 (3): 441–60. doi:10.1080/09654313.2012.651807.
- McCormick, K., S. Anderberg, L. Coenen, and L. Neij. 2013. "Advancing Sustainable Urban Transformation." *Journal of Cleaner Production*, no. 50: 1–11.
- McCormick, K. and Kiss, B. (2015) Learning through renovations for urban sustainability: The case of the Malmö Innovation Platform. *Current Opinion in Environmental Sustainability*, 16: 44-50.
- McGuirk, P. M. 2004. "State, Strategy, and Scale in the Competitive City: A Neo-Gramscian Analysis of the Governance of 'Global Sydney.'" *Environment and Planning A* 36 (6): 1019–43. doi:10.1068/a36131.
- McGuirk, P. M., H. Bulkeley, and R. Dowling. 2014. "Practices, Programs and Projects of Urban Carbon Governance: Perspectives from the Australian City." *Geoforum* 52 (March): 137–47. doi:10.1016/j.geoforum.2014.01.007.
- McGuirk, P., Bulkeley, H. and Dowling, R. (2016) Configuring carbon governance in the city: insights from Australia, *Annals of the Association of American Geographers*, 106 (1): 145-166.
- Monstadt, J. 2009. "Conceptualizing the Political Ecology of Urban Infrastructures: Insights from Technology and Urban Studies." *Environment and Planning A* 41 (8): 1924–42. doi:10.1068/a4145.
- ~~Rutland, T. and A. Aylett. 2008. "The Work of Policy: Actor Networks, Governmentality, and Local Action on Climate Change in Portland, Oregon." *Environment and Planning D: Society and Space* 26 (4): 627–46. doi:10.1068/d6907.~~
- Raven, R., Kern, F., Verhees, B., & Smith, A. (2016). Niche construction and empowerment through socio-political work. A meta-analysis of six low-carbon technology cases. *Environmental Innovation and Societal Transitions*, 18, 164-180.
- Schot, J., and F.W. Geels. 2008. "Strategic Niche Management and Sustainable Innovation Journeys: Theory, Findings, Research Agenda, and Policy." *Technology Analysis & Strategic Management* 20 (5): 537–54.
- Shove, E. and G. Walker. 2007. "CAUTION! Transitions Ahead: Politics, Practice and Sustainable Transition Management." *Environment and Planning A* 39: 763–70.
- Smith, A. and R. Raven. 2012. "What Is Protective Space? Reconsidering Niches in Transitions to Sustainability." *Research Policy* 41: 1025–36.
- ~~Swyngedouw, E. and N.C. Heynen. 2003. "Urban Political Ecology in Advanced Capitalist Countries." *Antipode: A Journal of Radical Geography* 35 (5): 898–918.~~
- ~~Swyngedouw, E. 2010. "Impossible Sustainability and the Post-Political Condition." In *Making Strategies in Spatial Planning*, edited by Maria Cerreta, Grazia Concilio, and Valeria Monno, 185–205. Urban and Landscape Perspectives 9. Springer Netherlands. http://link.springer.com/chapter/10.1007/978-90-481-3106-8_11.~~
- Truffer, B., Murphy, J.T. and Raven, R. (2015). The geography of sustainability transitions: Contours of an emerging theme. *Environmental Innovation and Societal Transitions* 17, pp. 63–72.
- * Voytenko, Y., K. McCormick, J. Evans, and G. Schliwa. 2015. "Urban Living Labs for Sustainability and Low Carbon Cities in Europe: Towards a Research

Agenda." *Journal of Cleaner Production*, no. In Press.
doi:10.1016/j.jclepro.2015.08.053.

"An overview of projects utilising ULL in Europe and discussion of key issues and insights from this emerging field of activity."

Wolfram, M. and N. Frantzeskaki. 2016. "Cities and Systemic Change for Sustainability: Prevailing Epistemologies and an Emerging Research Agenda." *Sustainability* 8 (2): 144. doi:10.3390/su8020144.